Section 5
Mitigation Actions

5.1 Goals of Mitigation Actions

Mitigation includes steps taken to avoid environmental impacts of an action; to minimize impacts by limiting the degree or magnitude of an action; to rectify impact by repairing, rehabilitating or restoring the affected environment; to reduce or eliminate impact over time by preservation and maintenance operations over the life of the action; and to compensate for impacts by replacing or providing substitute resources or environments.

If the US Department of the Army (DA) issued a permit for a project as proposed by the New Jersey Turnpike Authority (NJTA), mitigation of adverse environmental impacts from the project would be in order. This section sets forth generally an NJTA draft proposal to meet its obligation to mitigate. At this time, the US Army Corps of Engineers (USACE) does not express an opinion whether the NJTA proposal sets forth sufficient mitigation for a proposed project. USACE judgment as to the sufficiency of mitigation would be made as part of a Record of Decision prepared to accompany a DA permit, at such time as a permit might be issued.

The goals of the mitigation for either of the proposed construction alternatives include:

- Limiting the impact of project construction and operation on environmental, socioeconomic, and human health receptors.
- Meeting regulatory requirements and guidelines to compensate for unavoidable impacts, such as filling of wetlands or construction in floodplains.

Section 5.2 discusses construction-related mitigation that would be similar if either alternative were implemented. Section 5.3 details the mitigation measures proposed by the applicant for the Route 92 project. Section 5.4 discusses the mitigation that would be expected to be required if the US Route 1 Widening and Signal Removal alternative were built.

5.2 Construction-Related Impacts

5.2.1 Soils

In accordance with New Jersey State Law (NJSA 4:24-39 et. seq.), a certified erosion and sedimentation control plan, in compliance with practices established in *Standards for Soil Erosion and Sediment Control in New Jersey*, would have to be filed with the appropriate Soil Conservation District.

Mitigation measures in accordance with standards set forth in the above-referenced document would need to be implemented during and after construction. The most

efficient method by which to minimize soil erosion is to stabilize the soil immediately after disturbance has occurred. This could be accomplished by the following:

- Seeding immediately after the slope is graded with an appropriate groundcover.
- Placement of mulch or wood chips immediately after soil disturbance has occurred.
- Seeding of slopes simultaneously with road construction.
- Placement of temporary and permanent vegetative covers for soil stabilization.
- Placement of temporary stabilization of exposed soil on banks.
- Construction of temporary sediment basins.
- Installation of sediment barriers.
- Installation of drainage diversions.
- Placement of riprap for conduit outlet protection.
- Ensuring that the cut face of earth excavations and fills is no steeper than the safe angle of repose for the materials encountered and flat enough for proper maintenance.
- Ensuring that the permanently exposed faces of earth cuts and fills are vegetated or otherwise protected from erosion.
- Making provisions to safely conduct surface water to storm drains or suitable watercourses and to prevent surface runoff from damaging cut faces and fill slopes.
- Providing subsurface drainage in areas having a high water table, to intercept seepage that would adversely affect slope stability or building foundations, or create undesirable wetness.
- Ensuring that adjoining property is protected from excavation and filling operations.
- Ensuring that fill is not placed adjacent to the bank of a stream or channel unless provisions are made to protect the hydraulic, biological, aesthetic and other environmental functions of the stream.

Soils in portions of the Proposed Route 92 Corridor are acidic, having pH values that range from 4.0 to 6.0. Soils in the Route 1 Corridor may also be acidic. The construction specifications in the *Standards for Soil Erosion and Sediment Control in New Jersey* state, "exposed soils with a pH of less than 4.0 should be covered with a minimum of 12 inches of soil material no coarser than a sandy loam or soil material that can be corrected

to a minimum pH of 6.5." Certain areas within both project corridors may contain acid-producing deposits, as discussed in Section 3.

5.2.2 Fugitive Dust

Some of the measures that would be expected to mitigate the impacts of fugitive dust include:

- Spraying water or on exposed areas
- Covering trucks hauling dust generating materials to and from the site
- Washing wheels and underbodies of construction vehicles prior to departure from the site
- Reducing vehicle flow over non-paved areas
- Routinely cleaning paved areas to lessen the amount of dust available for re-suspension

5.2.3 Noise

Proposed Route 92 would be located in both residential and commercial areas, while the US Route 1 Widening and Signal Removal alternative would mainly affect commercial receptors. Appropriate construction noise mitigation measures would be required for either alternative. These measures may include:

- Implement a Community Relations Program to inform the public of any potential noise impact and any measures that would be employed to reduce these impacts.
- Coordinate early with the roadway designers to reduce construction noise levels by sequencing construction activities appropriately and locating noisier activities away from sensitive receivers.
- Ensure that all construction equipment would be equipped with exhaust mufflers and maintained to minimize engine noise.
- Limit construction activities to Monday through Friday from 7 a.m. to 5 p.m.

5.3 Route 92 Mitigation Actions

5.3.1 Acid-Producing Deposits

During construction of proposed Route 92 between Perrine Road and US Route 130, where excavation of the Magothy and Raritan formations may take place, NJTA proposes to implement mitigation measures to reduce exposure of acid-producing deposits. In accordance with NJDEP's *Technical Manual for Stream Encroachment*, acid-producing deposits would be handled as follows:

Acid-producing deposits exposed in the course of construction activities but intended to remain in their original locations would be promptly buried under 1 foot of soil in an effort to reduce oxygen availability and minimize the rate at which acid is produced.

Exposed acid-producing deposits, including earth contaminated with such deposits, that are not promptly backfilled and covered would be removed and disposed of on or off the construction site in a suitable manner and location. Acid-producing deposits moved from their original locations would not be discharged into streams, spread over uncontaminated soil, or sold or distributed as topsoil or topsoil amendments suitable for plant growth. Instead, the deposits would be buried at least 2 feet beneath the land surface, in such a manner that the cover material would not be subject to accelerated erosion.

Stockpiles of acid-producing deposits awaiting burial would be covered with pulverized limestone at the rate of 30 tons per acre (1375 pounds per 1000 square feet) and then covered with a minimum of 1 foot of compacted soil free of acid-producing-deposits within one week after exposure, or before the pH of a well-mixed sample from the uppermost two inches of the deposit drops to 3.0, whichever occurs first. Whenever practicable, deposits would be buried the same day they are excavated.

5.3.2 Streams and Floodplains

Federal Executive Order 11988, Flood Plain Management (May 24, 1977), requires agencies to reduce the risk of flood loss, minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains. Floodplain concerns were considered in the design of the proposed Route 92 project, and that construction in floodplains, particularly the placement of fill material, has been minimized to the greatest amount feasible.

Three of the floodplain fills proposed for Route 92 would exceed NJDEP's 20% net fill rule (N.J.A.C. 7:13-2.14(a)1, discussed in Section 4.2.3). The applicant requested exemptions for these floodplain fills in the Stream Encroachment Permit Application (Harris, 1999c).

Various forms of mitigation may be implemented to maintain the function and quality of the affected streams and floodplains during construction of proposed Route 92. These measures include the following:

- Bridges should be designed and constructed so that the natural streambed is maintained and not replaced by an artificial floor.

- Culverts should be designed with the capacity to pass the 100-year flood.

- Culverts should be designed to allow for the passage of fish during periods of low flow, where passage existed before project construction.

- Any proposed swales or channels discharging into an existing stream should incorporate the following: 1) settling basins to filter sediment prior to discharge into stream; 2) swales and channels stabilized with riprap, sod or appropriate vegetative cover prior to receiving stream flow; and 3) swales and channels designed to discharge in the direction of the existing stream flow and of a velocity so as not to cause erosion or interfere with the stream's natural flow pattern.

- Construction within streams and floodplains should take place during the anticipated low-flow period of July-August. This reduces the volume of water available to erode streambed soils, minimizing sediment transport downstream.

- Once construction within a stream is complete, disturbed areas should be stabilized and revegetated. Vegetation selected should be a ground cover species indigenous of the site.

- Construction materials should not be stockpiled in floodplain areas.

- Utilization of detention and/or retention basins that function to settle out sediment and some pollutants, thus improving the quality of water discharged downstream.

- Vegetative buffers, natural or manmade, should function to absorb sediment and pollutants from overhead runoff, provide food and cover for wildlife, stabilize soil to minimize erosion, and when present along a stream provide shade and suitable temperature regimes for aquatic life. At all stream encroachments, vegetative buffers should be restored if disturbed during construction. Trees, shrubs and herbaceous matter native to the existing stream should be planted and non-native species should be discouraged.

5.3.3 Water Quality

A stormwater management plan would be implemented to control runoff and treat stormwater from proposed Route 92 prior to discharge into the receiving water bodies. The NJTA's proposed stormwater management plan consists of a series of detention/water quality basins and/or grassed swales dependent upon various features affecting stormwater management design. Twenty-three stormwater management basins (SMBs) are proposed throughout the project corridor. The proposed Route 92 project was designed to comply with the water quality requirements of the Flood Hazard Area stormwater management regulations, N.J.A.C. 7:13-2.8, to the greatest extent possible. The proposed stormwater management plans were also reviewed to assess their compliance with the Stormwater Management rules, N.J.A.C. 7:8-5, adopted in February 2004.

In general, the use of detention basins was the chosen method to enhance water quality. The basins were designed to release no more than 90 percent of the total peak storage volume over a 36-hour period or, if this was not possible, a minimum outlet diameter of

three inches was provided. Figure 5-1 shows the locations of the proposed stormwater management basins.

In Design Section 1, SMBs 1A, 1B, 1D, 1F, 1G, and 1I were designed to provide sufficient storage volume so that outflow is restricted to a three inch orifice; however, the basins fully drain prior to the 36-hour detention period. Additionally, due to site constraints, sufficient storage volume for SMB 1E could not be provided for the water quality storm. Therefore, in addition to the three-inch orifice, outflow would also discharge through the second stage (i.e., rectangular orifice) in the outlet structure.

In the Devil's Brook floodplain east of the Amtrak Northeast Corridor (i.e., Design Section 2), a detention basin was not provided so as to minimize fill in wetlands. Water quality was provided for in the roadway design by virtue of the fact that the one-year flow at each of the twelve discharge locations within the floodplain would be low (1-2 cfs). The water quality requirement for these low runoff volumes would be achieved by sheet flow into the forested wetlands.

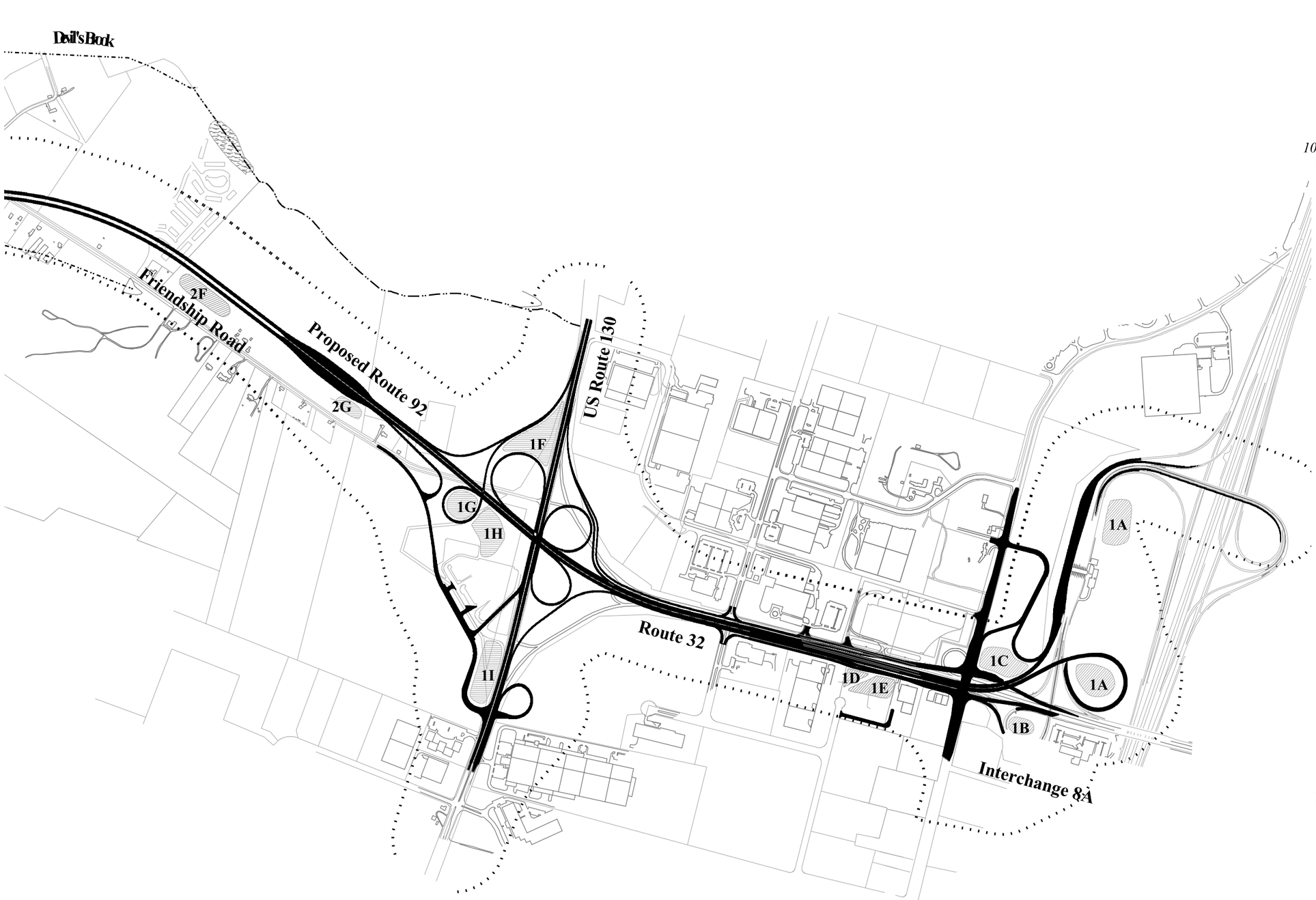
Detention basins are effective at removing pollutants via settling (i.e., pollutants that are sorbed to particles are removed). More soluble pollutants (such as nitrate) are less effectively removed from stormwater in detention basins. The following removal rates, compiled by Winer in the *National Pollutant Removal Database for Stormwater Treatment Practices*, can be considered typical (SMRC, 2003):

Pollutant	**Removal Rate (%)**
TSS	61±32[1]
Total P	20±13
Total N	31±16
NO_x	-2±23
Metals	29-54
Bacteria	78[2]

1 – Plus/minus values represent one standard deviation

2 – Based on less than five data points

The 2004 Stormwater Management rules require that stormwater management measures shall be designed to reduce the post-construction load of TSS in stormwater runoff generated from the water quality design storm by 80 percent, expressed as an annual average. NJDEP presumes extended detention basins to have a TSS removal rate of 40-60 percent (similar to the value listed above). Therefore, the design engineer may be required to add additional treatment or demonstrate that the proposed stormwater detention basins will in fact remove 80 percent of the TSS load.



N

0.1 0 0.1 0.2 Miles

1000 0 1000 Feet

Projection: Universal Transverse Mercator
Coordinate System: State Plane
Datum: NAD27

Data Source:

CAD files provided by DMJM - Harris.

Legend

- Stormwater Management Basin
- Open Water
- Proposed Mainline, Ramps and Roadway Reconfiguration
- Watercourse
- Project Area

Figure 5-1, Sheet 1
(Sheets 1 - 3)

Stormwater Management Basin Locations

US Army Corps of Engineers
Proposed Route 92
Environmental Impact Statement

CDM

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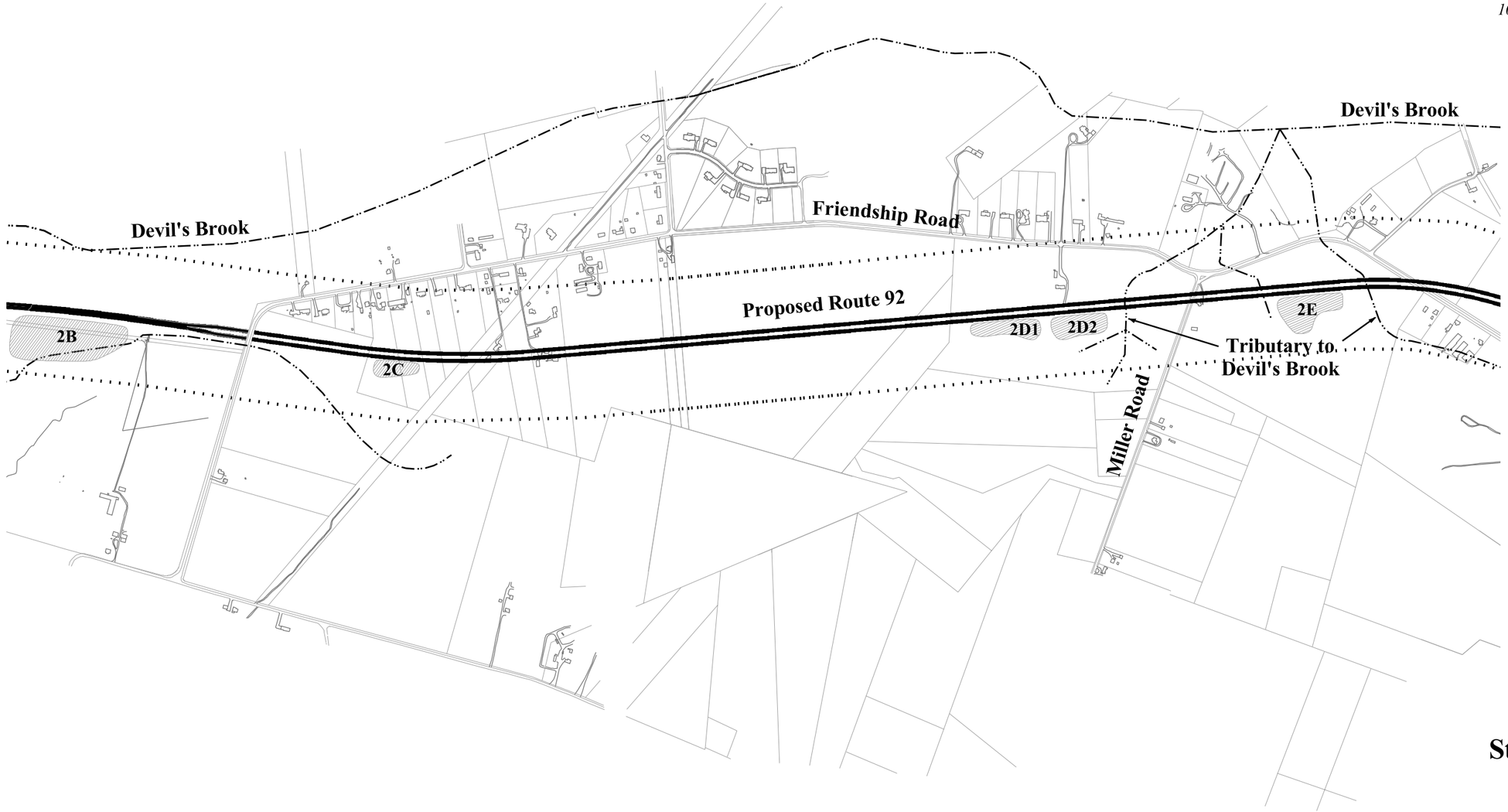

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0.1 0 0.1 0.2 Miles

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Projection: Universal Transverse Mercator
Coordinate System: State Plane
Datum: NAD27

Data Source:

CAD files provided by DMJM - Harris.

- Stormwater Management Basin
- Open Water
- Proposed Mainline, Ramps and Roadway Reconfiguration
- Watercourse
- Project Area

Figure 5-1, Sheet 2
(Sheets 1 - 3)

Stormwater Management Basin Locations

US Army Corps of Engineers
Proposed Route 92
Environmental Impact Statement

CDM

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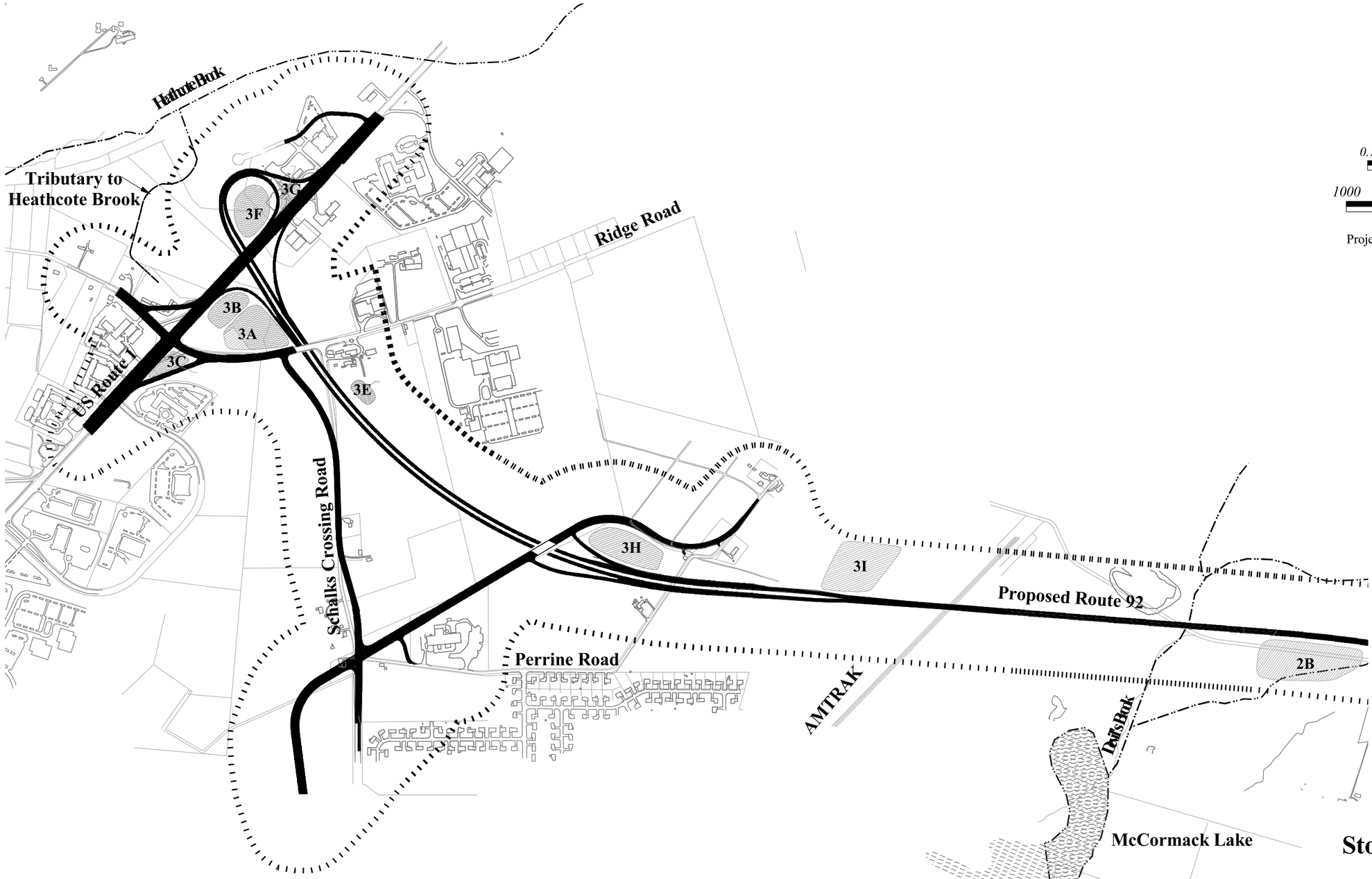

Figure 5-1, Sheet 3
(Sheets 1 - 3)

Stormwater Management Basin Locations

US Army Corps of Engineers
Proposed Route 92
Environmental Impact Statement

CDM

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Detention basins that are properly designed and maintained more successfully treat runoff before it is released. Stormwater management calculations for each section of the project are presented in Appendices A, B, and C of NJTA's Stream Encroachment Permit Application. A discussion of the justification for an exemption under N.J.A.C. 7:13-2.8(a)5 is provided in the Engineer's Report for Section 1 (see Appendix E).

The 2004 Stormwater Management rules (N.J.A.C. 7:8-5.4) require that the design engineer demonstrate that post-construction groundwater recharge is equal to pre-construction recharge, or that the increase in stormwater runoff volume of the two-year storm from pre-construction to post-construction is infiltrated. This analysis is not provided in the Engineer's Reports included with the Stream Encroachment permit application.

Refer to the Engineer's Reports in Appendix E for more information on the design and location of the SMBs.

5.3.4 Wetlands

NJTA states that the design of proposed Route 92 was developed and refined to comply with the "no net loss" wetland policy, which seeks to avoid and minimize wetland impacts to the greatest extent practicable. The process involves the evaluation of project alternatives to first avoid wetland impacts. The second step involves evaluation of project modifications to minimize unavoidable wetland impacts. The third step involves development of a mitigation program to mitigate for the unavoidable wetland impacts.

The proposed Route 92 alignment was selected to avoid wetlands to the extent practicable by proposing the highway in open field areas that are generally parallel with and south of Friendship Road. Wetland alteration to Wetland Units 1, 2, 3 and 7 mostly involve filling along the margins of the wetlands to avoid further fragmentation of the forested wetlands to the north and south of the proposed alignment. This design also looks to limit adverse effects to the wildlife habitat in these forested wetlands, as described in Section 4.2.3.4. Wetland Units 4, 5 and 6 are oriented in a north to south direction along Devil's Brook and the Amtrak tracks in the west central portion of the alignment. Due to their orientation, these Wetland Units could not be avoided if an effective connection to US Route 1 was to be achieved. The two finger-like extensions of the northern forest towards McCormack Lake provide secluded travel corridor habitat as well as a limited area of interior forest habitat.

NJTA looked to minimize wetland impacts by design modifications including reducing the median width through the Devil's Brook wetland complex and replacing slopes with retaining walls to minimize wetland filling. To further reduce wetland impacts and impacts to wildlife utilization of wetlands along Devil's Brook, bridges are proposed rather than fill to support sections of the roadway (see Figure 5-1). Shading impacts from the bridge structure may result in some modification of the underlying plant community; however, there would be less loss of wetland area and the wildlife travel

corridor would remain. See Section 4.2.3.5.3 for a discussion of wildlife habitat impacts and Section 5.3.5 for mitigation measures.

The highway storm drain system was designed with several storm water detention/water quality basins along the proposed highway. Although not proposed as wetland mitigation areas, these basins would serve wetland functions of flood storage, flood flow alteration, and sediment trapping. The wetland units along the alignment are all rated as high to moderate for these wetland functions. Use of stormwater best management practices would serve to reduce indirect wetland impacts associated with highway runoff, namely increased rates of runoff and effects of non-point source runoff constituents to surface water quality. The stormwater basins are designed to reduce the flood flow discharges from the highway by detaining runoff and releasing it slowly to adjacent lands and waterways. Removal of sediment and the contaminants adsorbed to sediment in project detention basins would reduce the amount to sediment transported to natural wetlands. The project detention basins would reduce sediment build-up in wetlands as compared to a drainage system with no detention basins.

The wetlands that would be temporarily altered during construction would be restored in place after construction is completed. Temporarily altered wetlands are those wetland areas that would be altered for construction of adjacent retaining walls, slope grading, temporary access roads or staging areas. Upon completion of highway construction, temporarily altered wetlands would be restored to pre-construction grades, and planted with native wetland plants to restore the plant community.

To mitigate for the unavoidable direct permanent wetland impacts, NJTA proposes to construct an approximately 57-acre wetland north and south of the proposed highway alignment, east of Haypress Road. The constructed wetland would have a hydrologic connection to the wetland bordering Devil's Brook. This would provide an approximately 4.5:1 ratio of constructed wetlands to permanently altered wetlands. (See Appendix D of the of the Section 404 permit application dated January 6, 1999 for details of the conceptual wetland mitigation plan.) This replacement area is located within the same watershed as the majority of the wetland losses, and is designed to create a wetland complex composed of open water area (0.85 acres), emergent marsh and wet meadow (12.24 acres), scrub-shrub wetland (8.2 acres) and forested wetland (36.7 acres). In addition, in accordance with NJDEP FWIP Special Condition #1, the NJTA proposes further mitigation in the form of preservation of 202 acres of existing forested wetland and upland in the vicinity of Friendship Road and Miller Road. Therefore, a total of approximately 260 acres would be preserved as a result of the mitigation plan.

NJTA states that the proposed Route 92 project was designed to avoid impacts to the maximum extent practicable via selection of an alignment that for the most part avoids wetlands. The project also minimizes unavoidable direct wetland impacts through design modifications such as reduced median width through wetlands, use of retaining walls in lieu of slopes in wetlands, and bridging Devil's Brook and the railroad tracks and their associated wetlands. The indirect impacts associated with highway runoff

would be minimized via the construction of an extensive highway stormwater management system designed to decrease peak rates of runoff and trap sediment and other constituents conveyed in highway runoff prior to discharge to adjacent lands and waterways. Lastly, construction of a mitigation wetland is proposed to offset wetland losses. The mitigation wetland would provide greater than a 4.5:1 ratio of mitigation wetland to lost wetlands.

5.3.5 Wildlife

NJTA states that the proposed Route 92 project looks to minimize adverse impacts to wetland and upland habitats by avoiding loss of important habitats to the extent practicable. Bridging Devil's Creek and the associated riparian forest reduces direct impacts to this travel corridor, its principal wildlife function. No additional measures are proposed to mitigate the highway project to the two forest tracts north of McCormack Lake. Where the highway would be constructed at grade, adjacent to or through other forested land, preserving existing trees or replanting trees within the right of way to the maximum extent practicable is intended. This would minimize loss of woodlands and minimize the horizontal extent of adverse edge impacts into these woodlands.

Planting trees along the entire highway alignment through open field areas (grassland habitat) is not contemplated. Planting trees along the highway would serve to constrict the fields with a tree row and reduce the use of these fields by grassland birds, which would perceive these fields as small isolated patches. Maintaining grassy strips along the highway through open field areas would maintain the "openness" of these areas. Essentially, birds would be more likely to perceive the grass strip along the highway extending to the adjacent open fields as a single area. Placement of shrub masses or tree clumps scattered along the highway would provide perching habitat for some grassland birds (e.g. eastern meadowlark, grasshopper sparrow, loggerhead shrike and northern shrike).

5.3.6 State Endangered Species - Southern Arrowhead

A portion of the state-endangered southern arrowhead population would be adversely impacted by construction of proposed Route 92. Locations of these plants within and outside of the proposed ROW have been located and surveyed. Field studies indicate that southern arrowhead tends to grow in areas with a relatively open canopy, deep organic layer in the substrate, and either moderate ponding or shallow depth to groundwater. Studies also concluded that southern arrowhead is likely growing in all areas of suitable habitat within the Devil's Brook area, and the species seems capable of colonizing microhabitats (i.e., precise locations within a habitat) that meet the necessary criteria for suitable habitat.

An estimated 25% of the southern arrowhead population within the proposed ROW would be impacted by the construction of Route 92. This impact would occur due to either disruption by construction equipment, filling or shading by construction. The

placement of snow fencing at the proposed limits of disturbance and monitoring of construction equipment movement would reduce the potential for arrowhead plants to be destroyed needlessly. Transplanting would be the preferred method for protecting individuals within the path of construction, and the chance of success for transplanting southern arrowhead is relatively good.

Individual plants within the limit of disturbance may be dug up prior to the start of construction activities and transplanted elsewhere within the Devil's Brook project area. Individual transplants should be distributed among the existing colonies of southern arrowhead, provided there appears to be sufficient microhabitat available to accommodate additional plants. If adequate area within existing colonies is not available, then alternative locations for transplanting the species must be identified.

As the preferred habitat of southern arrowhead is very specific and not always easily identified, transplanting to random locations within the Devil's brook area is not recommended. The findings of the field study can be used to identify specific locations that meet all the habitat criteria except for canopy cover. Selected trees can be removed in these locations to open the canopy. Southern arrowhead plants can then be transplanted into the areas of created habitat. Restriction on the timing of transplanting, length of time the plants can be held before transplanting, and methods of holding plants must be developed in order to maximize transplant success.

Another method for reestablishing the population lost due to construction of proposed Route 92 is seed propagation. Seeds can be collected from specimens within the Devil's Brook project area after flowering, or obtained from commercial seed sources (southern arrowhead is a common plant in the southeastern United States). The seeds would be propagated in a greenhouse environment and planted at the appropriate time into the appropriate habitat within the Devil's Brook area. As with the transplanting of existing individuals the propagated plants must be located either within existing colonies or within created habitat. This method could be used in combination with the transplanting of individuals. The advantages of this method either alone or with transplanting are the increased chance of success (i.e., percent survival of planted individuals) and the opportunity to increase the size of the population in the Devil's Brook area. If transplanting alone were performed and some of the plants did not survive, there would be a net loss of individuals from the project. If propagation were performed, then many more plants could be introduced to the Devil's Brook area, thereby increasing the likelihood that more plants would survive and become a viable population.

NJTA states that in an effort to save plants situated between the limits of disturbance and the ROW boundary, typical ROW line fencing would not be installed in the Devil's Brook wetland area.

In its review of the revised 1999 stream encroachment permit, the NJDEP Land Use Regulation Program contacted the NJDEP Office of Natural Lands Management,

Division of Parks and Forestry (DPF) regarding the southern arrowhead impacts resulting from the construction of proposed Route 92 and appropriate mitigation. The DPF made recommendations in their response Memorandum, dated June 30, 1999 regarding potential mitigation options for the southern arrowhead plants and habitat impacted by the proposed Route 92 project. The DPF noted their lack of experience with transplantation, but indicated that transplantation could be accomplished, provided that a rigorous monitoring and maintenance program for the transplanted plants were implemented.

5.3.7 Noise

Although up to six Category B receivers would experience noise levels that equal or exceed 67 dBA, only five were evaluated for noise abatement measures. The impacted residential receptors located outside the proposed Route 92 ROW are R-6, R-13, R-14, R-16 and R-17. The Boy Scout Council site (R-12) is located within the Route 92/US Route 1 ROW; therefore, NJTA proposes to acquire it as part of the Route 92 project. For the commercial receivers (C-1 and C-4) that were predicted to have noise levels equal to or greater than 72 dBA, FHWA regulations (23 CFR 722) state that NAC noise levels only apply to areas that have regular human use and do not apply to parking lots, industrial areas, and open spaces. FHWA does not require evaluating noise abatement measures that reduce exterior noise impacts for commercial land uses. In addition, barriers may not be suitable for commercial development, because they tend to block advertisement and visibility of the development from the street.

Noise abatement measures were evaluated based on procedures provided in *Highway Traffic Noise Analysis and Abatement Policy and Guidance* (FHWA, 1995) and *Policy for Construction of Sound Barriers* (NJTA, 1991). These noise abatement measures included:

- Traffic management measures (e.g. traffic control devices and signing for prohibition of certain vehicles types, time-use restrictions for certain vehicle types, modified speed limits and exclusive land designations);
- Alteration of horizontal and vertical alignments;
- Acquisition of property rights (either in fee or lesser interest) for the construction of noise barriers;
- Construction of noise barriers (including landscaping for aesthetic purposes) within or outside the highway right-of-way;
- Use of noise insulation at public use or nonprofit institutional structures.

The NJTA traffic noise policy for construction of sound barriers establishes criteria for evaluating noise abatement barriers. These criteria include:

- Noise levels from the New Jersey Turnpike must be projected to exceed an L_{eq} of 67 dBA at the exterior of the homes immediately adjacent to the Turnpike ROW;

- The New Jersey Turnpike roadway itself must be at least 12 feet closer to an existing home after construction;
- A proposed barrier must be expected to cause a minimum reduction of 4 dBA at the home(s);
- The cost of the proposed barrier must be less than $45,000 per dwelling unit to be protected;
- Construction of must be feasible from an engineering perspective in the opinion of NJTA, and
- The height of the barrier shall not exceed 26 feet, unless the NJTA Executive Director determines that extraordinary circumstances justify a higher barrier in a particular case.

The following subsections present the results of the noise abatement evaluation for the impacted receivers.

5.3.7.1 Traffic Management

In order to achieve a 5-dBA reduction, the speed limit would have to be reduced along designated portions of proposed Route 92 by approximately 25 mph (typically about a 1 dBA reduction for every 5 mph reduction in speed). This measure does not appear to be feasible because it would adversely affect traffic flow along proposed Route 92. Other approaches would require limiting truck traffic along proposed Route 92 or restricting the hours truck traffic would be able to access the highway. Neither option appears feasible given that Route 92 would be a major throughway in this region, and restrictions on truck traffic would be inconsistent with the stated purpose and need.

5.3.7.2 Horizontal and Vertical Alignments

NJTA does not consider adjustment of the horizontal or vertical alignment of proposed Route 92 to be a feasible option, given that existing vertical alignment is relatively flat and that adjusting the horizontal alignment would affect property owners adjacent to the corridor. In order to achieve a 5-dBA reduction, the road would have to be moved approximately twice the distance from where it is currently proposed from each affected receptor. For example, if a receptor were located 100 feet away from the edge of the proposed roadway, it would have to be adjusted another 100 feet away from its existing location.

5.3.7.3 Noise Insulation

As there are no public or nonprofit institutions in the project study area outside the proposed ROW, provision of noise insulation at institutional sites is not applicable as a mitigation measure.

5.3.7.4 Noise Barriers

Noise barriers are solid obstructions built between the highway and sensitive receivers along the highway. Effective noise barriers may reduce noise levels by 10 to 15 dBA. Barriers can be formed from earthen berms or from high vertical walls. Noise barriers do have limitations. These limitations include:

- To be effective, the barrier should extend along a highway four times as far in each direction as the distance from the receiver to the barrier.
- The barrier must break the line of sight from the roadway to the receptor in order achieve a 5-dBA noise level reduction.
- Openings in noise walls for driveway connections or intersecting streets severely reduce the effectiveness of the barriers.

Noise barriers were evaluated for each of the impacted residential receivers (R-6, R-7, R13, R-14, R-16 and R-17). Initially, a barrier height of 10 feet was chosen because it is the minimum height that was determined to achieve at least a 4-dBA noise level reduction for most of the receivers. A length of 600 feet erected at the ROW was evaluated to try to achieve the necessary 4-dBA-noise reduction at each receiver. However, a barrier of these dimensions did not meet the necessary 4-dBA noise reduction for receivers R-16 and R-17, and therefore, a barrier height of 12 feet was evaluated. The additional 2-foot increase in barrier height did provide greater noise reduction by an additional 1 dBA. However, neither the 10-foot nor 12-foot barrier heights would meet the NJTA cost limit of $45,000 per residential dwelling affected by noise (NJTA, 1991). Therefore, NJTA does not recommend a sound barrier for any of these locations. Table 5-1 presents a summary of the barrier evaluation.

Table 5-1
Noise Barrier Evaluation

OPTIMA Modeling Results [1]					**Receptor Data**	
Barrier Dimensions			**Cost**	**Max. Insertion Loss**	**No. of Benefited**	**Cost/Receptor**
height (ft)	length (ft)	area (ft2)	($)	(dB)	**Receptors**	($)
Receiver R-6 Sound Barrier						
10	600	6,000	120,000	7	1	120,000
Receiver R-13 Sound Barrier						
10	600	6,000	120,000	5	1	120,000
Receiver R-14 Sound Barrier						
10	600	6,000	120,000	5	1	120,000
Receiver R-16 Sound Barrier						
10	600	6,000	120,000	3	1	120,000
12	600	7,200	144,000	4	1	144,000
Receiver R-17 Sound Barrier						
10	600	6,000	120,000	3	1	120,000
12	600	7,200	144,000	4	1	144,000

Note: $20 per square foot of barrier was used as a cost estimation for evaluating cost effectiveness.

5.3.8 Land Use and Zoning

Vegetative screening is proposed wherever feasible between Route 92 and existing land uses.

NJTA indicates that property acquisition required for the proposed Route 92 ROW and relocation of current occupants would be conducted in accordance with the federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. Relocation assistance would be available to all displaced residents, businesses, and organizations.

Three ball fields owned by Princeton University would be displaced by realignment of Research Way to accommodate the proposed interchange between Perrine Road and Route 92. NJTA and Princeton University have discussed the possibility of reconstructing the ball fields on adjacent land.

5.3.9 Socioeconomics

Provision of emergency-only access to proposed Route 92 where it crosses Friendship Road would give the Monmouth Junction fire company and rescue squad access to Route 92 within two miles of their stations. This would reduce the difficulty of providing emergency services on the limited-access highway.

5.3.10 Transportation

Section 4.2.7 identified a potential undesirable impact of constructing proposed Route 92, namely an increase in the usage of Ridge Road between Route 27 and US Route 1 by trucks. A possible mitigation measure, if the proper approvals were secured, would be to restrict truck traffic on this section of Ridge Road to those trucks making pickups and deliveries along Ridge Road. Assuming compliance with and enforcement of the truck restriction, other trucks would divert to a variety of alternate routes, such as Raymond Road from US Route 1 to NJ Route 27, together with NJ Route 27 between Raymond Road and Heathcote Road.

Figures 5-2 and 5-3 display the projected changes (with respect to the No Action alternative) in 2028 peak-hour truck volumes in the Traffic Study Area that would result from the construction of Route 92, if truck usage of Ridge Road were restricted. Comparison to Figures 4-1 and 4-2 shows that traffic on Ridge Road would be expected to see a decrease in traffic volume on both sides of the road, rather than the volume increase expected on westbound Ridge Road if no truck prohibition is enacted.

5.3.11 Air Quality

Newer equipment used by contractors constructing proposed Route 92 would have to comply with the federal emissions standards discussed in Section 4.2.6.2. For older pieces of equipment, NJTA would require contractors to add particulate filters and catalytic oxidizers as "after treatment" technologies on construction equipment. Filters

Figure 5-2

2028 A.M.

Peak Hour Truck Volume Changes with Truck Prohibitions

Route 92 vs. No Action

US Army Corps of Engineers
Proposed Route 92
Environmental Impact Statement

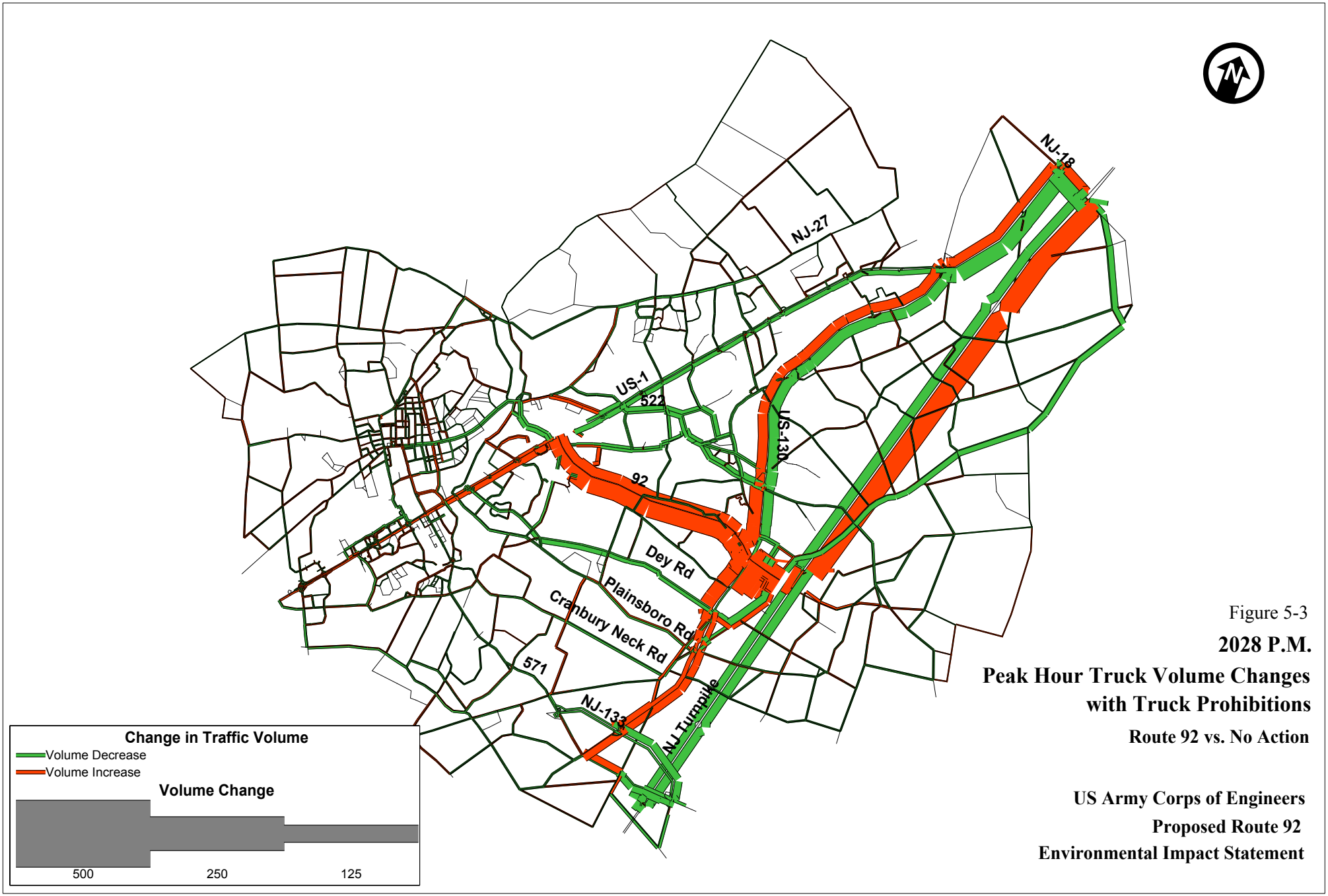

Figure 5-3

2028 P.M.

Peak Hour Truck Volume Changes with Truck Prohibitions

Route 92 vs. No Action

US Army Corps of Engineers

Proposed Route 92

Environmental Impact Statement

are used to remove and burn particulate emissions. Catalysts for diesel engines are used for reducing NO_x and particulate emissions by converting them to less harmful compounds.

Other measures recommended to mitigate impacts of fugitive dust include:

- Water or chemical dust suppressant spraying on exposed areas;
- Covering trucks hauling dust generating materials to and from the site;
- Washing wheels and underbodies of construction vehicles prior to departure from the site;
- Reducing vehicle flow over non-paved areas;
- Routinely cleaning paved areas to lessen the amount of dust available to be re-suspended.

NJTA will be required to implement measures to ensure that the construction phase of the project meets the state and federal ambient air quality standards and does not exceed the NO_x de minimis level of 25 tpy.

5.4 Route 1 Mitigation Actions

5.4.1 Acid-Producing Deposits

As there is the potential for acid-producing deposits to be present along the Route 1 Corridor between Northumberland Way and New Road, soil testing would need to be performed to determine whether or not these deposits exist. If it were determined that there are acid-producing deposits and that they would be exposed due to excavation, steps similar to those described in Section 5.3.1 would need to be taken to minimize the rate at which acid is produced.

5.4.2 Streams and Floodplains

The floodplains of Heathcote Brook and Oakeys Brook, as well as some of the tributaries to these streams, would be crossed if the US Route 1 Widening and Signal Removal alternative were implemented. As a result, any culverts, bridges, or other structures that would be added or modified within the floodplains would require mitigation similar to that described in Section 5.3.2. Minimization of fill within the floodplains would also be sought by regulatory agencies reviewing permit applications for this alternative.

5.4.3 Water Quality

Presumably, a stormwater management plan already exists for the Route 1 Corridor. If the US Route 1 Widening and Signal Removal alternative were implemented, the existing system would need to be upgraded to be able to convey and manage the quality of the additional stormwater that would be generated by the project.

5.4.4 Wetlands

The US Route 1 Widening and Signal Removal alternative is estimated to impact a total of 7.7 acres of wetlands if implemented. Since forested wetlands typically require mitigation at a ratio of 2:1, approximately 15.4 acres of wetlands would have to be created as mitigation, or an alternative method of mitigation proposed. In addition, any wetlands temporarily impacted due to construction easements would need to be mitigated in-place at the end of construction.

5.4.5 Land Use and Zoning

Acquisition of properties required for new US Route 1 interchanges and relocation of current occupants would need to be conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. Relocation assistance would need to be made available to all displaced residents, businesses, and organizations.

5.4.6 Socioeconomics

Gaps could be provided in the Jersey barriers dividing the northbound and southbound lanes of US Route 1 to allow emergency vehicles to make U-turns. This would mitigate the increase in response time caused by elimination of at-grade intersections.